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discovered any evidence that this is the case. Unfortunately the distinction between bedding and schistosity is not made clear. The secondary structure, by inference at any rate, is made coincident with the primary one, for we read that "the presence of a schistose structure is not always proof of origin from sediments."

Of course Professor Rice had a very difficult position to fill. He has filled it well, and yet we wish for the sake of the students who will use the revised text-book that he had departed a trifle more from Professor Dana's views, and incorporated in the book the latest results of investigations upon the oldest rocks of the globe and on metamorphism.

W. S. B.

MINERALOGY.

The Fourth Edition of Fuchs's Determinative Mineralogy.¹—

Although the *Anleitung zum Bestimmen der Mineralien*, by Prof. Dr. C. W. C. Fuchs, was first published thirty years ago, and has since been revised by Professors Streng and Brauns, the well-known volume still preserves its original excellent features. The third edition was published only eight years ago. Since this time there has been so much added to our knowledge of minerals that a fourth edition has been demanded. Dr. Brauns, who is responsible for the new edition, is eminently fitted for the work that has devolved upon him, and the new volume that has been brought out under his direction is fully abreast of the times.

There has been little change made in the sections treating of blowpipe and microchemical reactions except such as are necessitated by the progress of knowledge during the past decade. The tables for the determination of minerals, however, have been entirely reconstructed. The minerals are no longer separated into groups according to their crystal systems, but are divided according to hardness. These groups are further divided into two classes, *viz.*, minerals with metallic luster and those without metallic luster. The metallic minerals are next subdivided according to color, and the non-metallic ones according to the color of their streak. The cleavage, crystal form, and manner of occurrence serve further as distinguishing characteristics, and simple chemical tests are made use of for pur-

¹ Fuchs, C. W. C. *Anleitung zum Bestimmen der Mineralien*. Vierte Auflage, neu bearbeitet, von Dr. Reinhard Brauns. Giessen, J. Ricker, 1898. xii + 235 pp.

poses of final identification. As far as possible only those chemical reactions are described that are necessary to identify the minerals, and these are always simple ones.

The book is too well known to all mineralogists to require further characterization. It is sufficient praise to state that the fourth edition is an advance over all the editions that have preceded it.

W. S. B.

Hardness of Minerals.—Jaggat has described¹ a new instrument for the determination of the hardness of minerals. After briefly summarizing the results of previous workers on this subject, he describes the chief sources of error in their methods as follows : “(1) personal variability due to using ‘visibility’ of a scratch as determinant ; (2) inequalities of surface ; (3) undefined details of instrument. To eliminate (1) the depth of abrasion should be definite and measurable ; to eliminate (2) the surface should be artificial and defined, and the boring method, where only a very small portion of the surface is initially touched, should be used ; to eliminate (3) every part of the instrument, including the abrader, should be minutely defined, and for comparative determination an empirical standard should be fixed.”

The instrument devised to overcome these difficulties and to meet the other conditions of the problem presented is intended to be applied to the microscope in order that the measurements may be made either on a crystal face or the surface of a thin section, that the test may be applied to very small portions of mineral, and that the control of the instrument may be very exact. “The principle of the instrument is as follows : a diamond point of known, constant dimensions is rotated on an oriented mineral surface, under uniform rate of rotation and uniform weight, to a uniform depth. The number of rotations of the point, a measure of the duration of the abrasion, varies as the resistance of the mineral to abrasion by diamond ; this is the property measured. The instrument consists of the following parts :

- (1) A standard and apparatus for adjusting to microscope with various adjustments.
- (2) A balance beam and its yoke.
- (3) A rotary diamond in the end of the beam.
- (4) Apparatus for rotating uniformly.

¹ Jaggat, T. A., Jr. A Microsclerometer for Determining the Hardness of Minerals. *Am. Jour. of Sci.*, vol. iv, pp. 400-412, 1897.

Also *Zeit. f. Krystall.*, vol. xxix, pp. 262-275, 1898.